Subject Description Form

Subject Code	EIE2901/IC2114
Subject Title	Industrial Centre Training I for EIE
Credit Value	5 training credits
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	The objective of this subject is to equip students with knowledge and skills through technical training that are fundamental and essential in their study and professional practice in electronic and information engineering (EIE).
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** 1. apply engineering drawings for technical communication and produce layout on CAD with application in electrical, electronic and information engineering; 2. explain legal duties related to occupational safety, identify common workplace health and safety hazards, corresponding control measures and apply personal protection equipment; 3. apply and create computer program on scientific computing software for technical analysis and modelling; 4. design electronic circuit on printed wiring board with EDA tool; 5. prescribe and use basic electronic instrument to perform parametric test and analysis on simple electronic circuit, troubleshooting, create and apply virtual instrument and identify common electronic product safety tests; 6. recognize training as an important part for a professional engineering career and the needs for multi-disciplinary training and continual professional development in professional engineering practice. 7. explain the manufacturing, assembly, interconnection, and operation of mechatronic products and machines, specify system components and production process, and construct simple prototype for test and investigation; 8. generate control programmes for building or industrial embedded systems.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. <u>Engineering Drawing for EIE (18 hours)</u> 1.1. Computer-aided Design (CAD) engineering drawing; basic 2D geometry and functions: point, lines, circle and arc; zoom control; trim fillet and erase; dimensioning, text and label; line type; colour; layer and essential AutoCAD editing functions. 1.2. CAD exercises with AutoCAD: Building plans, use of grid system, floor plan, elevation and section, telecommunication structural cabling, use of symbols and conventions in building services provision. 2. <u>Industrial Safety Overview (15 hours)</u> 2.1. Safety Management: Overview, essential elements of safety management, safety training, accident management, and emergency procedures. 2.2. Safety Law: F&IU Ordinance and principal regulations, OSH Ordinance and principal regulations.

	2.3. Occupational Hygiene and Environmental Safety: Noise hazard and control; dust hazard and control; ergonomics of manual handling. 2.4. Safety Technology: Mechanical lifting, fire prevention, dangerous substances and chemical safety, machinery hazards and guarding, electrical safety, first aid, job safety analysis, fault tree analysis, personal protective equipment. 3. Application of Computing Tool (21 hours) 3.1. Introduction to Python; interactive calculations and basic operations with basic data type; mathematical operations, matrix and array operations, data analysis and curve fitting; data manipulation and data file processing. 3.2. Script programming & debugging; logic operations & flow control; Use of functions and popular Python packages, such as Numpy, Panda and Matplotlib; Data visualization by using graphics packages. 4. Electronic Circuit Design Practice (18 hours) 4.1. Introduction to electronic design automation (EDA) software; circuit schematics capture and representation; placement of components, capturing, annotation, labelling, net list. Electronic parts library, symbols, decals, physical packages, discrete components, integrated circuits, logic and analogue circuits, electronic parts creation and application. 4.2. Printed Circuit Board (PCB) design, hands on practice on PCB circuit design with EDA tools. 4.3. Wiring diagram and wiring table for electronic and electrical installation, functional representation of circuit, system block diagram, electrical & electronic device symbols and layout, circuit artwork, etching process, prototype PCB fabrication. 5. Electronic Measurement with Product Safety Test and Practice (15 hours) 5.1. Application and use of electronic test instruments: current and voltage measurements, two wire and four wire techniques, power supply and signal sources, oscilloscope probes and oscilloscopes. 5.2. Introduction to Virtual Instrument, application and hands-on practice on LabVIEW. 5.3. Electronic product safety test methods: for example, High Voltage Isolation Test, Insulation Resistance Test, Continuity Test, Leakage Current Measurement. *One of the following streams as decided by hosting programme* **Stream A:** 6. Electronic Workshop Practice for EIE (36 hours) 6.1. Introduction to common electronics parts, use of basic test instruments, best practice and basic troubleshooting techniques, electronic workshop safety. 6.2. Introduction to electronic assembly design and manufacturing process, components, tools and machines. 6.3. Introduction to electronic circuit interconnect technologies like Surface Mounted Technology (SMT) and Chip-on-board (COB). 6.4. Introduction to advanced electronic packaging and assembly process such as: fine-pitch SMT, Ball Grid Array (BGA), Flip-chip and Chip Scale Package (CSP). 6.5. Soldering and de-soldering techniques, mounting and installation of electronic circuits, wiring of subassemblies.

	6.6. Hands-on practice on basic electronic circuit troubleshooting, including both digital & analogue circuitries. 6.7. Introduction to rapid prototyping for electronic design using tools like breadboard and circuit simulation software. 6.8. Introduction to rapid prototyping for mechanical design using 3D printing equipment and CAD tools. 7. Embedded System Application and Practice (27 hours) 7.1. Introduction to Microchip Microcomputer families and development tools. 7.2. Hands-on practice on memory, I/O, data communications, ADC operations. 7.3. Hands-on practice on LED and LCD displays. 7.4. Hands-on practice on motor control and sensors. 7.5. Application of Microcomputer on consumer electronic products, mechatronics, home automation products, wired and wireless connectivity. **Stream B:** 8. Basic Mechatronics Practice (27 hours) 8.1. Design approach of mechatronic system design; Key elements of mechatronic system, sensing device, controller, actuators, human-machine interfaces and input & output signal conditioning unit. 8.2. Introduction of design and operation of typical mechatronic systems 8.3. Introduction of controllers and basic programmable control concept, overview of system structure of controllers, Input/Output (I/O), programming languages, instructions and technique, programming software and applications of controllers such as Programmable Logic Controller (PLC). 9. Integrated Building Systems (36 hours) 9.1. Basic concepts and application methods for integrated building system. 9.2. Lighting control systems; dimming functions, blind / shutter controls, light-scene controls. 9.3. Heating/Cooling HVAC system control scheme. 9.4. PID control function loops; BMS control system for industrial applications. 9.5. Building system project planning for realistic work applications; On-line and Off-line program integration test; Fault monitoring and reporting systems.
Teaching/ Learning Methodology	The teaching and learning methods include lectures, workshop tutorials, and practical works. The lectures aim at providing students with an overall and concrete background knowledge required for understanding key issues in engineering communication, use of standard engineering components and systems, and importance of industrial safety. The workshop tutorials aim at enhancing students' in-depth knowledge and ability in applying the knowledge and skills to complete specific tasks. The practical works aim at facilitating students to review the diverse topics covered in this course and perform active learning with research, practice, questioning, and problem solving in a unified activity.

Alignment of Assessment and Intended Subject Learning Outcomes

Specific Assessment Methods/ Task	% Weighting	Intended Subject Learning Outcomes to be Assessed							
		1	2	3	4	5	6	7	8
Continuous Assessment									
• Assignment / Project	30%	✓	✓	✓	✓	✓		✓	✓
• Tests	30%	✓	✓	✓	✓	✓		✓	✓
• Reports & Logbook	40%	✓	✓	✓	✓	✓	✓	✓	✓
Total	100%								

Specific Assessment Methods/ Task	Remarks
Assignment / Project	The projects are designed to facilitate students to reflect and apply the knowledge periodically throughout the training.
Tests	Tests are designed to facilitate students to review the breadth and depth of their understanding on specific topics.
Others (Reports & Logbook)	Report writing is designed to facilitate students to acquire deep understanding on the topics of the training and to present those concepts clearly.

Student Study Effort Expected

Class contact (Time-tabled)	
• Lecture/Tutorial	10 Hours
• Workshop	140 Hours
Other student study effort	0 Hour
Total student study effort	150 Hours

Reading List and References

Reference Software List:

1. AutoCAD from Autodesk Inc.
2. PADS from Mentor Graphics Inc.
3. LabVIEW from National Instrument
4. MPLAB from Microchip Corp.

Reference Standards and Handbooks:

5. IEEE Standard 315 / ANSI Y32.2 / CSA Z99 Graphic Symbols for Electrical and Electronics Diagrams
6. IEC 61082 Preparation of Documents used in Electrotechnology
7. IPC-D-279-1996, Design Guidelines for Reliable Surface Mount Technology Printed Board Assemblies, IPC.
8. IPC-J-STD-001F-2014, Requirements for Soldered Electrical and Electronic Assemblies, IPC.
9. IPC-A-610F-2014, Acceptability of Electronic Assemblies, IPC.

Reference Books:

10. R.S. Villanucci, A.W. Avtgis, W.F. Megow, *Electronic Techniques: Shop Practices and Construction*, 7th ed., Practice-Hall, 2002.

	11. Training material, manual and articles published by Industrial Centre 12. D. Shetty, R. Kolk, "Mechatronics System Design", PWS Publishing Company, 1997 13. EMSD, Code of Practice for the Electricity (Wiring) regulations, 2003 Edition.
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